

The great fertility of the atomic theory has produced such a mass of systematic knowledge that the province of atomics is easily defined. Moreover, the definiteness and comparative simplicity of atomic systems makes classification easy. This is still more striking in the case of electronics, which perhaps may be even more productive of systematic knowledge than atomics has been. To some, attention to nomenclature is considered trivial, but early in his career Faraday remarked the importance of clever definitions which he always recorded, and demonstrated by his example the close relation between the progress of science and its nomenclature. Moreover, if the main purpose of science is economy of thought, it is as necessary to systematize and classify facts already known, as to discover new facts only to have them buried unappreciated.

BOTANY.—*Notes on the genus Dahlia, with descriptions of two new species from Guatemala.* W. E. SAFFORD, Bureau of Plant Industry.

The impression that the many "double-flowered" dahlias of our gardens are forms created by modern horticulturalists from single-flowered types is erroneous. In the earliest illustration of plants belonging to this genus, made more than three centuries and a half ago, only double-flowered forms are represented. Indeed, the genus itself was based by Cavanilles on *Dahlia pinnata*, a plant with double heads identical in form with certain "peony-flowered" dahlias of modern catalogues. Francisco Hernandez, the *protomedico* of Philip II, sent by his sovereign in 1570 to New Spain to study its resources, figured at least three dahlias under the Aztec names *Acocotli*, *Cocoxochitl*, and *Acocoxochitl*, all of which are derived from *cocotli*, signifying, like the word "syringa," a hollow-stemmed plant; *acocotli* literally translated becoming "water-cane," or "water-pipe;" *cocoxochitl*, "cane-flower" or "hollow-stem flower": and *acocoxochitl*, "water-pipe-flower." It is interesting to note, in connection with this vernacular name, that it was also applied by the Aztecs to plants of distinct families, including umbellifers, one

of which, an aromatic *Ligusticum* with a hollow stem and fleshy roots resembling those of the genus *Dahlia*, was erroneously figured under the same heading as the two dahlias first described.



Fig. 1.—Duplex-flowered Dahlia, called Acocotli by the Aztecs. After Hernandez (1575).

Hernandez was not a botanist, but grouped his plants according to their uses and appearance, rather than to their botanical affinities.¹ Two of his figures, representing dahlias of the type

¹ In connection with the hollow-stemmed umbellifer of Mexico, it may be of interest to note that from the hollow stems of the allied *Cicuta* the shepherds of Virgil and Theocritus made pan-pipes, or syrinxes, "*disparibus septem compacta cicutis fistula.*"

now called "Duplex," with leaves like those of *Dahlia variabilis*, were poorly drawn (see fig. 1), but a third figure, reproduced in the accompanying illustration (fig. 2) was that of a Dahlia with



Fig. 2.—Peony-flowered Dahlia, called Acocoxochitl by the Aztecs. After Hernandez (1575).

flowers of the "peony type" and with leaves resembling those of *Dahlia glabrata*. This figure was accompanied in the Roman edition of Hernandez's work by a very brief and inadequate description. In the Madrid edition² it is described under the

² Vol. 1, p. 14, cap. 24.

heading "*De Acocoxochitl seu flore Acocotli*," as having flower heads with yellow disk and purple ray-florets, after which the author goes on to say that many more forms of *Acocoxochitl* occur in Mexico, differing from one another in the size and color of the flowers, some of them white, others yellow, others purple or red, others white tinged with purple, or perhaps yellow tinged with red, and a great many other kinds, in some cases with double or multiple whorls of ray flowers, either forming circles or clustered in compact bunches (*manipuli*). The roots he describes as fleshy, or succulent, and fascicled like those of asphodel, with a resinous or somewhat sweetish artichoke-like taste.

Although both the flowers and leaves of cultivated dahlias show considerable variation, yet there are certain features in both which are more or less uniform. In one group of the genus the ray-florets are broad and flat; in another they have a tendency to become involute or quilled, while in a third the margins are bent backward or revolute. These distinct groups are further characterized by their foliage, the leaves of which, whether simple, pinnate, or bipinnate, have a peculiar texture and vary similarly in form. Very little attention is paid to the leaf-characters of dahlias either in standard works on horticulture or in florists catalogues. A well defined species like *Dahlia coccinea*, for instance, may be found under the heading *leaves once pinnate*, in spite of the fact that in the original drawing of the type plant the lower leaves of this species have their lower pinnae again pinnate. In consequence of this carelessness and also perhaps from the fact that the lower leaves of the forms figured in catalogues are seldom shown, some authors have gone to the extent of uniting into a single species Cavanilles' *Dahlia pinnata*, *D. rosea*, and *D. coccinea*.

In nearly all the monographs on the genus *Dahlia* hitherto published the different varieties have been grouped from the horticulturalists' point of view, according to the forms of the flowers, under such headings as "single, duplex, anemone-flowered, collarette, pompon, fancy, decorative, peony-flowered, and cactus dahlias," without identifying the single-flowered forms with botanical species (except perhaps in *Dahlia coccinea* and

Dahlia imperialis) or attempting to connect the "duplex" and double forms with their primitive single ancestors. It is very probable that the types upon which several species have been based were hybrid plants. *Dahlia pinnata* itself, the type of the genus, was probably a hybrid. In the Index Kewensis its name is discarded as a synonym for the subsequently described *D. variabilis*. In the same way the handsome *Dahlia juarezii* with large double heads composed of strap-shaped florets having their edges turning backward, in sharp distinction to the involute or quilled florets of the artificial-looking "pompon dahlias" and the broad, flat-rayed heads of the "century" type of modern catalogues, is also to be regarded as a hybrid. Dahlias with flowers identical in form with the type of *Dahlia juarezii*, the ancestor from which the "cactus dahlias" of our gardens have sprung, are no longer called "cactus dahlias" by specialists, but "cactus hybrids." One of the ancestors of *Dahlia juarezii* must have been a single flowered species, with eight revolute ray-florets. Such a plant has recently been discovered in the mountains of Guatemala by Mr. Paul Popenoe, in honor of whom it is proposed to name the species described below. In addition to this species Mr. Popenoe brought back with him a handsome tree Dahlia, already represented in the U. S. National Herbarium, but hitherto erroneously referred to *Dahlia imperialis* by some authorities and by others to *Dahlia variabilis*. This second species represented in the herbarium by two sheets collected in Guatemala by Mr. William R. Maxon, is described below under the name *Dahlia maxonii*.

There are several other undescribed species of the genus Dahlia in the National Herbarium, but there is no space within the limits of this paper to describe them. Indeed the whole genus should be carefully revised by a botanist familiar with closely allied genera of composites and the work should be based upon material collected in the elevated regions of Mexico and Central America where the plants are endemic, not upon garden-grown specimens. Much of the material in herbariums is incomplete, owing to the absence of characteristic lower leaves of the plants represented; and many of the specimens are in

bad condition, owing both to the difficulty of drying succulent plants like dahlias, which wilt as soon as gathered, and to the injury of the flower heads by insects.

Dahlia popenovii Safford, sp. nov. *Tepeacocoxochitl* (Nahuatl); *Papalotl, Tunaita* (Guatemala).

A herbaceous plant about 1 meter high with fascicled, fleshy roots and slender, erect, hollow, striated, purplish stems glabrate near the base and sparsely clothed above with minute, whitish, woolly hairs. Leaves membranaceous, opposite with the bases of the petioles connate, as in the rest of the genus, the lower ones (lacking in the type) described as bipinnate; the upper ones simply pinnate, usually 3-foliate, or simple and deeply 3-lobed, with the leaflets or lobes decurrent on the rachis and winged petiole, sparsely clothed with short, stiff hairs; leaf-like bracts of the inflorescence simple, lanceolate, acuminate, sessile; leaves of young seedlings simple, broadly ovate, with the base decurrent on the slender petiole. Inflorescence more or less corymbose, with the flower heads borne on long slender, petioles, erect or slightly curved at anthesis, at length recurved or nodding; peduncles 12 to 14 cm. long bearing one or two bracts, sometimes with a shorter-peduncled head issuing from the axil of the bract. Flower heads 6 to 9.5 cm. broad, those of the type with bright scarlet or cardinal rays and yellow disks; outer involucre calyx-like, as in the rest of the genus, composed of 5 spreading or recurved spathulate-oblong bracts; inner involucre composed of about 10 erect, diaphanous, oblong scales, rounded at the apex, enlarging after anthesis; ray florets 8, sterile, widely spreading, rounded and abruptly pointed at the tip, revolute or turning backward along the margins as in forms of the "cactus" type of cultivated dahlias; disk florets hermaphrodite, tubular; mature achenia 12 or 13 mm. long, concealed by the thin, diaphanous paleae borne on the disk, these resembling the scales of the inner involucre and almost equal to them in size.

Type in the U. S. National Herbarium, no. 1010584, collected near San Lucas, Department of Zacatepequez, Guatemala, at an approximate altitude of 6600 feet, October 21, 1916, by Wilson Popenoe (no. 682).

This handsome species, which is probably an ancestor of the hybrid *Dahlia juarezii*, from which the "Cactus Dahlias" of our gardens have been derived, is named in honor of its discoverer, Mr. Wilson Popenoe, of the Office of Foreign Seed and Plant Introduction. It is represented by a single specimen, and by several seedlings propagated at Yarrow, Maryland, from seeds collected by Mr. Popenoe. In Mr. Popenoe's field notes he writes as follows:

Antigua, Guatemala, October 23, 1916.—On my way back from Guatemala City to this place I collected some wild dahlias about 2 kms. above Santa Lucia, at an approximate elevation of 6600 feet, where the plants were most abundant. I have not seen them as low



Fig. 3.—*Dahlia popenovii*, showing two flower heads, mature fruiting head, upper leaves of mature plant and a single leaf of a young seedling; also a ripe acheneum. Drawn from type material and from a photograph of the flower by Mrs. R. E. Gamble, Bureau of Plant Industry. All natural size.

as 5000 feet, but have found them up to 7000, which is as high as I have gone. I do not know how much higher they may occur. The plants observed near Santa Lucia grow to a height of about 4 feet. The stem is a dull greenish purple to purplish green, usually glabrous but sometimes with scattering hairs toward the upper portion. Leaves 2-pinnate near the base of the stem, 1-pinnate or simple above; leaflets of the lower leaves ovate acute, 2.5 inches long, 1.5 inches broad, remotely dentate, sparsely furnished with short bristly hairs, which are more scant beneath; rachis not exceeding 5 inches in length, often very short; petiolules 0 to 0.75 in. long. The flowers are 2 to 3.25 in. broad, with 8 ray florets, the latter sterile and orange brown or crimson in color, in some forms short and broad, in others long and narrow with the margins recurved or revolute, giving to the flower the appearance of a Cactus Dahlia, and contrasting with the other form having broadly spreading flat rays rounded at the tips.

From photographs of these contrasted forms it is evident that the latter species is the true *Dahlia coccinea* of Cavanilles, the type figure of which it exactly resembles.

Dahlia maxonii Safford, sp. nov. Tree Dahlia of Guatemala. *Tzoloj* (Kekchi); *Shikor* (Pokomchi); *Quauhacocoxochitl* (Nahuatl).

A tall plant with vertical terete hollow stem 3 to 5 meters high and 5 to 7 cm. thick, at length becoming woody, with joints at intervals formed by the clasping bases of the connate petioles of the opposite leaves. Leaves membranaceous, pale green beneath, deep green above, quite smooth or sparsely hairy, those of the inflorescence and on the upper part of the stem simple or pinnate, those on the lower portion of the stem bipinnate; leaflets lanceolate, terminating in a long slender point, the terminal leaflet narrowed and the lateral ones rounded and unequal at the base, with the blades more or less decurrent on the narrowly winged rachis, the margins dentate (the larger leaflets with 16 to 18 teeth on each side), the lower pair often bilobed and sometimes with an additional pair of small leaflets at the base, as in several other species of the genus; leaves of young seedlings simply pinnate, with the rachis scarcely or not at all winged. Flower heads peduncled, erect; peduncles 10 to 12 cm. long, those of axillary heads somewhat shorter and subtended at the base by simple caudate-acuminate leaf-like bracts narrowed at the base into a winged petiole 1 or 2 cm. long; involucre composed of two distinct series, the outer consisting of 5 green, fleshy, widely spreading, spathulate-ovate bracts obtuse at the apex 10 to 15 mm. long and 5 to 8 mm. broad, the inner of about 10 membranaceous diaphanous, oblong, scales rounded at the apex, overlapping before anthesis, at length erect, 18 to 20 mm. long and 8 to 10 mm. broad. Ray florets neutral, lavender-pinkish or lilac, ovate, flat, widely spreading as in the cultivated forms of the "century type," 4 to 5 cm. long and 2 to 3 cm. broad with the apex rounded or abruptly pointed; disk-florets hermaphrodite, often sterile, tubular,



Fig. 4.—*Dahlia maxonii*, showing fully expanded flower, two unopened buds, disk floret, and achenium, together with a bipinnate and a simple leaf. Natural size. Drawn by Mrs. R. E. Gamble.

sharply 5-toothed, yellow, 10 mm. long; mature achenia, 1.5 mm. long.

Type in the U. S National Herbarium, no. 473271, collected at Socoyocté, Department of Alta Verapaz, Guatemala, January 16, 1905, by William R. Maxon (no. 3295).

DISTRIBUTION: Mountains of Alta Verapaz, Guatemala, and across the boundary into the state of Chiapas, Mexico.

This handsome tree dahlia is named in honor of Mr. William R. Maxon, collector of the type material. It is further represented in the U. S. National Herbarium by specimens from Sepacuité, Alta Verapaz, collected by George P. Goll (no. 224), Guatemala, without definite locality, by Heyde (no. 319) and Mrs. William Owen (no. 2a "Tzoloj"); in cultivation near Guatemala City by Wilson Popenoe (no. 728); and in the vicinity of San Cristobal, state of Chiapas, Mexico, at an elevation of 7000 to 8800 feet, by E. W. Nelson (no. 3173).

In Mr. Maxon's field notes he describes it as a plant "8 to 15 feet high; flowers lavender-pinkish, 4 inches across; buds and young shoots eaten as 'greens;' a very common plant." Mr. Popenoe's notes, dated Tactic, Alta Verapaz, Guatemala, December 16, 1916, are as follows:

"This tree dahlia is extensively used here for hedges. The stems are cut and inserted in the ground, projecting three or four feet; they take root and grow, and when the plants have reached ten or twelve feet in height they produce quantities of lilac-pink flowers, three to five inches broad. Just now they are in all their glory, and Tactic is brilliant with them. This impresses me as being an unusually fine decorative plant. It should be cultivated in the United States. In addition to the typical form, — single pink, — three others are known in this region. Some of them may be distinct species. The people say they are wild plants. One resembles the typical form except that it is quite double. Another is a single white, its flowers resembling those of the single pink in everything except color. The fourth form is double white. The flowers of this form are very handsome and are used by the Indians to adorn the images of saints which they keep in their houses. Don Matias Acevedo says that water contained in the hollow stems is medicinal. It is used here as a gargle in cases of sore throat. This plant is called *shikor* in Pokomchi, which is the language spoken in Tactic. In Kekchi, which is the language spoken throughout most of the Alta Verapaz, the name is *tzoloj*."